

Papahānaumokuākea Marine National Monument
RESEARCH Permit Application

NOTE: *This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).*

ADDITIONAL IMPORTANT INFORMATION:

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.
- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.
- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

Send Permit Applications to:

Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
nwhipermit@noaa.gov
PHONE: (808) 397-2660 FAX: (808) 397-2662

SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.

Papahānaumokuākea Marine National Monument Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

Summary Information

Applicant Name: Amy Baco-Taylor

Affiliation: Florida State University

Permit Category: Research

Proposed Activity Dates: 25 October - 16 December 2014

Proposed Method of Entry (Vessel/Plane): Vessel R/V Sikuliaq

Proposed Locations: Northwest Hancock Seamount, Southeast Hancock Seamount, Zapadnaya Seamount, Pioneer Bank, West and East Northhampton Seamounts, Seamounts NW of Monument into Emperors. Additional seamounts in Monument between East Northampton and the NW end of Monument may be added if extra time at the end.

Estimated number of individuals (including Applicant) to be covered under this permit:

13

Estimated number of days in the Monument: 50

Description of proposed activities: (complete these sentences):

a.) The proposed activity would...

The goal of this project is to address recovery potential and time scales of recovery for deep-sea coral and sponge beds that have been affected by trawling. Deep waters in the Monument on many of the island and seamounts were affected by trawling prior to the establishment of the EEZ. The requested permit is for Year 1 of this project which will provide high-resolution multibeam on many of these features as well as photographic surveys.

b.) To accomplish this activity we would

Our goals in Year 1 of this project are to conduct high-resolution multibeam mapping of the targeted features to depths of at least 600m. Then we will deploy an AUV on each of these features to conduct photo and video transects in the same depth range. No sampling of live organisms will occur on this cruise. We will also collect CTD data and water samples (radiocarbon, nutrient, isotopic, and total alkalinity) at each location.

c.) This activity would help the Monument by ...

This project will both substantially increase our knowledge of the deep-water communities within the monument as well as provide a better understanding of trawling impacts and recovery potential for deep-sea coral and sponge communities.

Other information or background:

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Baco-Taylor, Amy R.

Title: Associate Professor

1a. Intended field Principal Investigator (See instructions for more information):

Amy Baco-Taylor

2. Mailing address (street/P.O. box, city, state, country, zip):

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

For students, major professor's name, telephone and email address:

3. Affiliation (institution/agency/organization directly related to the proposed project):

Florida State University

4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):

Brendan Roark, Co-PI, Texas A&M University, [REDACTED]
Nicole Morgan, Student, Florida State University, [REDACTED];
Arvind Shantharam, Student, Florida State University, [REDACTED];
Erin Easton, Student, Florida State University, [REDACTED];
Mackenzie Schoemann, Student, Texas A&M University, [REDACTED];
Kelci Miller, Student, Texas A&M University, [REDACTED];
Greg Kurras, Seafloor Investigations LLC - multibeam contractor, part of Sentry team
Lizet Christiansen, Seafloor Investigations LLC - multibeam contractor
Sean Kelley, Sentry Expedition leader, Woods Hole Oceanographic
Johanna Hansen, Sentry, Woods Hole Oceanographic
Justin Fujii, Sentry, Woods Hole Oceanographic
Mike Skowronski, Sentry, Woods Hole Oceanographic

Section B: Project Information

5a. Project location(s):

- | | | | |
|-------------------------------------------------------|-------------------------------------|----------------------------------------|-------------------------------------|
| <input type="checkbox"/> Nihoa Island | <input type="checkbox"/> Land-based | <u>Ocean Based</u> | |
| <input type="checkbox"/> Necker Island (Mokumanamana) | <input type="checkbox"/> Land-based | <input type="checkbox"/> Shallow water | <input type="checkbox"/> Deep water |
| <input type="checkbox"/> French Frigate Shoals | <input type="checkbox"/> Land-based | <input type="checkbox"/> Shallow water | <input type="checkbox"/> Deep water |
| <input type="checkbox"/> Gardner Pinnacles | <input type="checkbox"/> Land-based | <input type="checkbox"/> Shallow water | <input type="checkbox"/> Deep water |
| <input type="checkbox"/> Maro Reef | | | |
| <input type="checkbox"/> Laysan Island | <input type="checkbox"/> Land-based | <input type="checkbox"/> Shallow water | <input type="checkbox"/> Deep water |
| <input type="checkbox"/> Lisianski Island, Neva Shoal | <input type="checkbox"/> Land-based | <input type="checkbox"/> Shallow water | <input type="checkbox"/> Deep water |
| <input type="checkbox"/> Pearl and Hermes Atoll | <input type="checkbox"/> Land-based | <input type="checkbox"/> Shallow water | <input type="checkbox"/> Deep water |
| <input type="checkbox"/> Midway Atoll | <input type="checkbox"/> Land-based | <input type="checkbox"/> Shallow water | <input type="checkbox"/> Deep water |
| <input type="checkbox"/> Kure Atoll | <input type="checkbox"/> Land-based | <input type="checkbox"/> Shallow water | <input type="checkbox"/> Deep water |
| <input checked="" type="checkbox"/> Other | | | |

Remaining ashore on any island or atoll (with the exception of Midway & Kure Atolls and Field Camp staff on other islands/atolls) between sunset and sunrise.

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location Description:

Northwest Hancock Seamount, Southeast Hancock Seamount, Zapadnaya Seamount, Pioneer Bank, West and East Northhampton Seamounts, Seamounts NW of Monument into Emperors. Additional seamounts in Monument between East Northampton and the NW end of Monument may be added if extra time at the end.

5b. Check all applicable regulated activities proposed to be conducted in the Monument:

- Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
- Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands
- Anchoring a vessel
- Deserting a vessel aground, at anchor, or adrift
- Discharging or depositing any material or matter into the Monument
- Touching coral, living or dead
- Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
- Attracting any living Monument resource
- Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
- Subsistence fishing (State waters only)
- Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

6. Purpose/Need/Scope *State purpose of proposed activities:*

The goal of this project is to examine a series of locations in the far Northwestern Hawaiian Islands (NWHI) and the Emperor Seamount Chain (ESC) to address the hypothesis, based on predictions of low resilience and decadal recovery times for seamounts, that deep-sea coral beds in the NWHI have not recovered despite the end of trawling 30+ years ago. It is likely that the initial colonizers to a seamount coral community following large-scale disturbance would be from long-distance dispersal events. Given that this first dispersal event will be a largely stochastic process, we also hypothesize that the initial colonization of a seamount may take decades, and that the initial cohort will be the key source of propagules for subsequent recruitment to a given site. To test these, we will survey a series of replicate seamounts in three trawling “treatment” types (designated based on previous trawling activity level) using AUV and surveys.

This is the first cruise of a two-year project. Year 1 is designed to conduct broad surveys and identify areas where corals occur on each feature. We will request another permit in Year 2 to return to these sites with an ROV to collect specimens and further video data. We will focus on three specific aspects of the seamount communities: community structure, age structure of precious corals using a verified size-age curve, and genetic structure of precious corals using DNA microsatellites. Using these methods we will be able to constrain time since coral colonization as well as source populations of recent colonizers.

Related to photography below, we are not targeting any federally protected species with our work, however, scleractinians are protected by CITES and may occur in our AUV survey areas. We have also previously observed Hawaiian Monk Seals within precious coral beds. Therefore we may incidentally photograph these federally protected animals while the AUV is doing its photo transects, however there will be no effort made to approach or endanger them.

*Considering the purpose of the proposed activities, do you intend to film / photograph federally protected species? Yes No

For a list of terrestrial species protected under the Endangered Species Act visit:

<http://www.fws.gov/endangered/>

For a list of marine species protected under the Endangered Species Act visit:

<http://www.nmfs.noaa.gov/pr/species/esa/>

For information about species protected under the Marine Mammal Protection Act visit:

<http://www.nmfs.noaa.gov/pr/laws/mmpa/>

7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?

Multibeam, CTD and AUV work do not require any bottom contact, and therefore should not disturb any seafloor organisms or habitats. We will deploy a current meter at Pioneer Bank at a depth of approximately 450m. This will sit on the bottom at this site for 1 year. The footprint is 12" on a side with a concrete drop weight that will be left on the seafloor after recovery of the instrument. The AUV will have steel drop weights attached, which will be left on the seafloor (see attached AUV information sheet for further detail on drop weights). Steel dropweights will degrade over time and have minimal impact on the seafloor communities (compared to lead drop weights).

While we do not anticipate the multibeam activities will impact marine species in the area, we will follow standard mitigation techniques including using a "soft start" or "ramp up" to the maximum noise output of the multibeam (Barlow and Gisner 2006). The main hypothesis with stranding related to anthropogenic noise is that animals will be startled by the noise and swim to the surface too rapidly and thereby experience barotrauma. A slow start up will provide a warning for these species, if present. We will also scan the area for marine mammals before starting the system and wait until any that might be present have left the area before starting the multibeam system. Finally, we are able to host a NOAA observer(s) if the monument chooses to provide one.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects? We do not anticipate the proposed activities will diminish any of the Monument resources in any way. The AUV is designed to avoid bottom contact and to that end flies at 3-5 meters above the bottom. Therefore it should not cause any harm to any resources.

We anticipate this work will enhance the Monument by providing greater knowledge of the deep-sea community that falls within the Monument's waters, as well as potentially providing evidence as to whether the protection provided by the Monument is resulting in recovery of the deep-sea communities.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.

The Monument is unique as probably the only place in the world where once trawled seamounts have been protected for >10 years, thus it is by far the best place to conduct this research. Since it has been >30 years since the establishment of the EEZ, we will be able to test the hypothesis that deep-sea coral and sponge communities require decades for recovery from trawling impacts.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?

There are no adverse impacts beyond any caused by the presence of a ship.

This work will contribute to the Monument as well as our understanding of the time-scales over which deep-sea habitats may recover from large-scale disturbance, thereby, promoting efficient stewardship of the high seas and other locations.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.

The locations of our study sites requires extensive transit from Honolulu and between sites. Additionally, both multibeam mapping and AUV video collections require extended time periods to provide high quality data. The duration of the activity is determined by the endurance capability of SIKULIAQ not the purpose of the research which will take longer than one cruise to accomplish because of the vast area of study. The project is planned for two cruises; one in 2014 and a follow on cruise in 2015. To get the most scientific return for the investment, the duration of the 2014 research cruise (and time spent within the Monument) has been planned to take full advantage of the ship's on site endurance taking into account the long transit legs from and back to Honolulu. To optimize this valuable time on station, previous bottom mapping data collected within the Monument (e.g. recent Falkor cruises) is being used to refine the science station locations for 2014. Data collected from 2014 will in turn be used to further refine the study locations in 2015.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

Baco-Taylor has extensive field experience, having served as Chief Scientist on 7 Pisces/ROV RCV-150 cruises and co-Chief Scientist on 1 Alvin cruise and 1 Tangaroa cruise. Since 1995, she has participated in 36 oceanographic cruises and completed 54 submersible dives, as well as numerous ROV dives. Roark has participated in 11 oceanographic cruises including the use of both submersibles and ROVs. Both PIs have extensive experience working throughout the Main and NWHI.

Baco-Taylor's research has largely focused on Hawaiian precious corals, including developing and screening microsatellite markers for *C. secundum* and *C. laauense* and analyzing the resulting data. Baco-Taylor also has extensive experience with multivariate statistics. Roark has been responsible for all the radiocarbon dating of precious corals in the Hawaiian Islands that has illustrated their extreme longevity (Roark et al., 2009, 2011, Roark and Parrish 2009, Houlbreque et al. 2010). Thus, both PIs have the required experience in the field, the lab, and in data analyses to make the proposed project a success. Please see the attached CV's for additional details.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

This project is supported by the National Science Foundation (NSF) grant to Baco-Taylor and Roark. NSF has supplied the ship-time and also funding to both Baco-Taylor and Roark to complete this project through to publication of results.

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.

We do not anticipate any impacts to the Monument as a result of our activities. The surveys methods we have proposed are standard oceanographic multibeaming methods and AUV video surveys.

i. Has your vessel been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?

It is the applicant's understanding that the RV Sikuliaq will be fitted with VMS prior to its departure from Honolulu.

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.

Since we will have little or no bottom contact, there are no other factors we are aware of that need to be considered.

8. Procedures/Methods:

The target depth range for all operations will be the range in which trawling was most active, 300-600m. We will conduct 27 AUV sentry dives (3 at each site, 3 of which fall within the Monument for a total of 9 AUV dives within the Monument) we anticipate spending ~90 hrs. at each of our target seamounts.

Multibeam and Backscatter - We will conduct a multibeam survey with backscatter to assess the terrain and bottom type using the shipboard multibeam system on the RV Sikuliaq. The Sentry group will process the multibeam data in preparation for the AUV dive, and we have included a subcontract for Seafloor Investigations LLC, who will process the backscatter data. Given that many of the features in this area are larger than we can cover with the AUV in the allotted time at each feature, obtaining and processing backscatter data for each site prior to launch will be critical to narrow the survey area to regions of each feature dominated by hard substrate, our focal habitat type. We conservatively estimate surveys of approximately 11km²/hr. at a rate of 6 knots and 300m water depth. The multibeam system will be run 24/7 during both transits and on station, except when it needs to be shut off to allow for accurate tracking of the AUV. In deep operating mode the EM302 multibeam system is 237 dB while the EM710 is 229 dB. In shallow mode the EM302 is 232 dB and the EM710 is 225 dB. The frequency of the EM302 is 30kHz and the EM 710 is 70 to 100kHz. We are not aware of any studies that indicate that these frequencies have an impact on marine mammals and these systems are identical to those operated by the Falkor within the Monument in 2014.

Further Information on Anthropogenic Noise and its Effects on Marine Species:

The main concerns with anthropogenic noise are at low and mid-frequencies (10Hz-25kHz). At these and lower frequencies, there is a range of decibels that are considered dangerous to marine mammals and fishes, but higher than 25 kHz (the ship systems are 30kHz+) is considered background noise and will not propagate far enough from the source to affect outside animals (Hildebrand 2009). Studies of possible acoustic sources of known beak whale strandings concur with this (Cox et al 2006) finding that all possible culprits are low or mid frequency. While we do not anticipate the multibeam activities will impact marine species in the area, we will follow standard mitigation techniques including using a "soft start" or "ramp up" to the maximum noise output of the multibeam (Barlow and Gisner 2006). The main hypothesis with stranding related to anthropogenic noise is that animals will be startled by the noise and swim to the surface too rapidly and thereby experience barotrauma. We will also scan the area for marine mammals before starting the system and wait until any that might be present have left the area before starting the multibeam system. Finally, we are able to host a NOAA observer(s) if the monument chooses to provide one.

AUV - We will use the AUV to conduct down-looking camera surveys and to acquire CTD and oxygen data. The primary purpose of the camera surveys will be to document the benthic fauna of each of the features. The angle of the AUV camera combined with the height it must be flown over new terrain, provide for little ability to identify species or even families of corals (C. Fisher pers comm.) or colony size. Thus, the AUV will be used to assess coral presence, abundance, and density and habitat parameters, providing a first-order assessment of recovery. They will also be key for selecting areas to return to with the ROV on Cruise 2. We may also be able to discern evidence of trawling (e.g. Waller et al. 2007). The images will also be used to measure substrate parameters to tie to benthic community data. For further information on the AUV operations and weights, please see attached document. For a total of 27 AUV dives with a weather contingency added in, we anticipate a maximum of 310 plates bolted into 93 chunks will be left on the seafloor across the entire study area. (The size and weight of the chunks are outlined in the attached document on the AUV weights.) Since only 3 of these sites fall within in the Monument, ~103 total plates in 31 chunks will be left in Monument waters, with 10-11 chunks at each of 3 sites.

Water Sampling - A suite of normal water samples will be taken from the niskin bottles off of the CTD rosette for the following analyses, radiocarbon (250ml), nutrients (20ml), alkalinity (250 ml), oxygen (100 ml), stable isotope of oxygen and deuterium (25ml), dissolved inorganic carbon (DIC) (25ml), trace elements (10 L) and filtered for particulate organic matter (POC)(3-5 L). Each analysis is an individual specimen but samples for each analyses will not be collected on each CTD cast. For example we anticipate only doing one radiocarbon profile at each of the 9 sites.

TCM-1 current meter and data logger - A TCM-1 current meter with data logger (specifications attached) will be deployed at Pioneer Bank. The current meter is made from PVC and aluminum and will be attached to a single concrete block 12"x12"x1.75" (from Home Depot) weighing 10-20lbs in seawater, as an anchor. Since concrete is carbonate, it should be non-toxic to any marine life. This current meter will be recovered by the ROV in year 2 with the concrete weight

left on the seafloor. The current meter will be deployed by dropping it over the side as a free vehicle.

Hazmat material will be used in the processing of some of the water samples. The mercuric chloride is used to stop biological process from continuing by adding 100 µl to the radiocarbon, alkalinity, and DIC samples and then sealing the containers. A small amount (~50µl) of dilute hydrochloric acid is added to the POC filters, and sealed in containers. All the water samples and all the unused hazmat will be removed from the ship and returned to Texas A&M in order to conduct the analyses.

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding, as a customized application will be needed. For more information, contact the Monument office on the first page of this application.

9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):

Common name:

We only plan to collect water samples.

Scientific name:

& size of specimens:

Collection location:

Whole Organism Partial Organism

9b. What will be done with the specimens after the project has ended?

na

9c. Will the organisms be kept alive after collection? Yes No

na

• General site/location for collections:

• Is it an open or closed system? Open Closed

• Is there an outfall? Yes No

• Will these organisms be housed with other organisms? If so, what are the other organisms?

• Will organisms be released?

10. If applicable, how will the collected samples or specimens be transported out of the Monument?

The water samples will be transported onboard the Sikuliaq to Honolulu, where they will be shipped to Texas A&M. Water samples will be housed in the laboratory of Dr. Brendan Roark at Texas A&M University where most of the analyses will be conducted. The one exception is the radiocarbon samples (laboratory is yet to be determined) but unused material will be returned to Texas A&M University.

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:

This is a collaborative effort between 2 scientists A. Baco-Taylor and B. Roark, who have previously worked independently in the Hawaiian Archipelago. They are sharing this project to prevent duplication of effort.

12a. List all specialized gear and materials to be used in this activity:

AUV Sentry - operated by Woods Hole Oceanographic Institution
Sikuliaq shipboard Multibeam
Sikuliaq shipboard CTD
TCM-1 Data Logger - Lowell Instruments

12b. List all Hazardous Materials you propose to take to and use within the Monument:

- 2-5 ml mercuric chloride to poison water samples
- 400 ml dilute hydrochloric acid to decalcify filtered particulate organic samples.

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:

2-3yrs

We anticipate at least 1-2 publications developing from this phase of the project, with additional publications expected from the activities planned for year 2. There will likely

also be presentations at scientific meetings to present these findings. We would be happy to work with the Monument if specific outreach products are desired related to the findings of the cruise.

15. List all Applicants' publications directly related to the proposed project:

Figueroa, D. and A.R. Baco. Octocoral mitochondrial genomes provide insights into the phylogenetic history of gene order rearrangements, order reversals, and also into the use of mitochondrial genomes for cnidarian phylogenetics. Submitted 01/14 to Genome Biology and Evolution.

Parrish, F., A.R. Baco, C. Kelley, and H. Reiswig. 2014. State of Deep Coral and Sponge Ecosystems in the United States Western Pacific Region: Hawaii and the United States Pacific Islands. Submitted for The State of Deep Coral Ecosystems of the United States 2012. NOAA Technical Memorandum in press.

Morrisson, C., A.R. Baco, M. Nizinski, D.K. Coykendall, A. Demopoulos, T. Shank, and W. Cho. 2014. Spotlight: Population Connectivity of Deep-Sea Corals. Submitted for The State of Deep Coral Ecosystems of the United States 2012. NOAA Technical Memorandum in press.

Figueroa, D. and A.R. Baco. 2014. Complete mitochondrial genomes elucidate the phylogenetic relationships of the deep-sea octocoral Families Coralliidae and Paragorgiidae. Deep-Sea Research, doi:10.1016/j.dsr2.2013.06.001.

Long, D. and A.R. Baco. 2014. Rapid change with depth in megabenthic structure-forming communities in the Makapu'u deep-sea coral bed. Deep-Sea Research, doi:10.1016/j.dsr2.2013.05.032.

Sinniger, F., O. Ocana, and A. Baco. 2013. Diversity of Zoanthids (Anthozoa: Hexacorallia) on Hawaiian Seamounts: Description of the Hawaiian Gold Coral and Additional Zoanthids. PLoS ONE 8(1): e52607. doi:10.1371/journal.pone.0052607

Schlacher, T., A.R. Baco, A. Rowden, T. O'Hara, M. Clark, C. Kelley, and J. Dower. 2013. Seamount benthos in a cobalt-rich crust region of the central Pacific: conservation challenges for future seabed mining. Diversity and Distributions. doi: 10.1111/ddi.12142

Baco, A.R. and S.D. Cairns. 2012. Comparing molecular variation to morphological species designations in the deep-sea coral genus *Narella* reveals new insights into seamount coral ranges. PLoS ONE 7(9): e45555. doi:10.1371/journal.pone.0045555

Yesson, C., M. Taylor, D. Tittensor, A. Davies, J. Guinotte, A.R. Baco, J. Black, J. Hall-Spencer, A. Rogers. 2012. Global habitat suitability of cold water octocorals. Journal of Biogeography 39(7): 1278-1292.

Clark, M.R., C. Kelley, A.R. Baco, A. Rowden. 2011. Fauna of cobalt-rich ferromanganese crust seamounts. International Seabed Authority Tech Study No. 8

Herrera, S., A.R. Baco, and J.A. Sanchez. 2010. Molecular systematics of the bubblegum corals (Paragorgiidae, Octocorallia): phylogenetic relationships with Sibogorgia and description of a new deep-sea species. *Molecular Phylogenetics and Evolution*. 55(1): 123-135.

Tittensor, D.P., A.R. Baco, P. Brewin, M.R. Clark, M. Consalvey, J. Hall-Spencer, A.A. Rowden, T. Schlacher, K. Stocks and A.D. Rogers. 2009. Predicting global habitat suitability for stony corals on seamounts. *Journal of Biogeography* 36: 1111–1128.

Baco, A.R. 2007. Exploration for deep-sea corals on North Pacific seamounts and islands. Invited for special volume of *Oceanography* 20(4): 58-67.

Waller, R.G., and A.R. Baco. 2007. Reproductive morphology of three species of deep-water precious corals from the Hawaiian Archipelago: *Gerardia* sp., *Corallium secundum* and *Corallium lauuense*. *Bulletin of Marine Science*. 81(3): 533-542.

Parrish, F.A., and A.R. Baco. 2007. Chapter 4: State of Deep Coral Ecosystems in the United States Western Pacific Region: Hawaii and the United States Pacific Islands. pp. 155-194. In: S.E. Lumsden, T.F. Hourigan, A.W. Bruckner G. and Dorr (eds.) *The State of Deep Coral Ecosystems of the United States*. NOAA Technical Memorandum CRCP-3. Silver Spring MD 365 pp.

Rogers, A.D., Baco, A., Griffiths, H., Hart, T. and Hall-Spencer, J.M. 2007. Corals on Seamounts. Chapter 8 in Pitcher, T.J., Morato, T., Hart, P.J.B., Clark, M.R., Haggan, N. and Santos, R.S. (eds) *Seamounts: Ecology, Conservation and Management*. Fish and Aquatic Resources Series, Blackwell, Oxford, UK. pp 141-169.

Baco, A.R., A.M. Clark, and T.M. Shank. 2006. Six microsatellite loci from the deep-sea coral *Corallium lauuense* (Octocorallia: Coralliidae) from the islands and seamounts of the Hawaiian archipelago. *Molecular Ecology Notes* 6: 147-149.

Etnoyer P.J., S.D. Cairns, J.A. Sanchez, J.K. Reed, J.V. Lopez, W.W. Schroder, S.D. Brooke, L. Watling, A. Baco-Taylor, G.C. Williams, A. Lindner, S.C. France, and A.W. Bruckner. 2006. *Deep-Sea Coral Collection Protocols*. NOAA Technical Memorandum NMFS-OPR-28, Silver Spring, MD. 53 pp.

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With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as “confidential” prior to posting the application.

Signature

Date

**SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE
BELOW:**

Papahānaumokuākea Marine National Monument Permit Coordinator
6600 Kalaniana'ole Hwy. # 300
Honolulu, HI 96825
FAX: (808) 397-2662

DID YOU INCLUDE THESE?

- Applicant CV/Resume/Biography
- Intended field Principal Investigator CV/Resume/Biography
- Electronic and Hard Copy of Application with Signature
- Statement of information you wish to be kept confidential
- Material Safety Data Sheets for Hazardous Materials